HANDBOOK OF PHONOLOGICAL DATA
FROM A SAMPLE OF THE WORLD'S LANGUAGES

A Report of the Stanford Phonology Archive

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705 Navaho

705 01 p

705 02 t
[t-unreleased][60]

705 03 t-aspirated[01]
[t/x][61]
(free)
[t/c-fricative][02 62]
(free)
[t/x-labialized][63]
(free)

705 04 t-ejective[03]

705 05 k
[k/gamma][64]
[k/j-fricative][02 64]
[k/gamma-labialized][64]
[k-unreleased][60]

705 06 k-aspirated[01]
[k/x][61]
(free)
[k/c-fricative][02 62]
(free)
[k/x-labialized][63]
(free)

705 07 k-ejective[03]

705 08 k-aspirated-labialized[04 30]

705 09 t/s

705 10 t/s-aspirated[05]
[t/s/x][61]
(free)
[t/s/c-fricative][02 62]
(free)
[t/s/x-labialized][63]
(free)

705 11 t/s-ejective

705 12 t/l-fricative[06]

705 13 t/l-fricative-aspirated[06]

705 14 t/l-fricative-ejective[06]

705 15 t/s-hacek

705 16 t/s-hacek-aspirated

705 17 t/s-hacek-ejective

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18 s
[s-syllabic][66]

19 z

20 s-hacek
[s-hacek-syllabic][66]

21 z-hacek
[z-hacek-syllabic][66]

22 x[07 31]
*[x-labialized]
[c-fricative][02 07]

23 x-labialized[31 67]
(loan,allo,free)
*/x/
*/h-labialized/

24 gamma[07 31]
*[yod]
[j-fricative][02 08 68]
[gamma-labialized][09 32 69]
(allo,free)
*/w/

25 m[33]

26 m-preglottalized[10 34]
(surface)

27 n[11 35]
[n-syllabic][70]

28 n-preglottalized[10 34]
(surface)

29 l[06]

30 l-fricative[06]
[l-fricative-syllabic][66]

31 glottal stop

32 h[12 37]

33 h-labialized[38]
*[x-labialized]

51 iota

52 i-long

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53 iota-nasalized

54 i-long-nasalized

55 epsilon
[e][71]

56 epsilon-long

57 epsilon-nasalized
[e-nasalized][72]

58 epsilon-long-nasalized

59 a[13]

60 a-long

61 a-nasalized[13]

62 a-long-nasalized

63 o-open
[upsilon]
(free)

64 o-long
[u-long]
(free)

65 o-open-nasalized
[upsilon-nasalized]
(free)

66 o-long-nasalized
[u-long-nasalized]
(free)

67 yod[08 14 68]
(tag(-),free)
*/gamma/

68 yod-preglottalized[15 34]
(surface)

69 w[32]
*[gamma-labialized]

81 high

82 low

705 $a Navaho $d Athapascan $e Arizona $f 120,000 $g Merritt Ruhlen$g John Crothers (review)

705 $a Sapir, Edward and Harry Hoijer $b 1967 $c The Phonology and Morphology of the Navaho Language $f University of California Publications in Linguistics, No. 50 $g Berkeley: University of California Press

705 $a HALF-LONG VOWELS (NON-DISTINCTIVE) $A Before a voiceless spirant long vowels are shortened to half-long. This rule also applies in word final position where vowels must be followed by /h/. No examples given. (p.11)

705 $a **LONG CONSONANTS (NON-DISTINCTIVE)** $A Following a short vowel the initial consonant of the next syllable is "mechanically lengthened." Apparently all consonants are affected, but Hoijer cites only /s-hacek/, /z-hacek/ and /yod/. (p.3)

705 $a **MORPHEME STRUCTURE** $A Derivational prefixes are generally of the form: CV, CVV, or CVh (syllabic /n/ being analyzed as CV). Most frequent consonants: /t, n, yod, h, glottal stop/. Vowels are generally /a, iota, o-open/ or /a-long, i-long, o-long/. (p.13) $A Paradigmatic (inflectional) prefixes are of the form: CV, CVh, CVCV, C, V, Vh, VV, VVd, and high tone. The vowel is usually /iota/, but others occur. (p.14)

705 $a **MORPHEME STRUCTURE** $A CV(V)(C) $A "Stem morphs conform to the following specifications in regard to phonemic shape: (1) Nearly all stem morphs begin with a consonant. A few, belonging to nouns and postpositions begin with a vowel and these are always bound.... Any consonant except /h/ may begin a stem morph but /yod/ occurs only before the vowels /a, a-nasalized, o-open, o-open-nasalized/. Certain other consonants (/s, s-hacek, l-fricative, x, m, m-preglottalized, n-preglottalized, w, yod-preglottalized/) are rare as initials of stem morphs. (2) The vowel may be long or short, oral or nasal.... [The diphthongs] /a.iota/, /epsilon.iota/, and /o-open.iota/ occur with some frequency and /a.o-open/ very rarely. The remaining diphthongal clusters and all the syllabic consonants never occur in stem morphs. (3) Stem morphs may terminate in a vowel or consonant. Only /t, k, n, s, z, s-hacek, z-hacek, l-fricative, l, h, glottal stop/ appear as finals of stem morphs." (4) Stem morphs usually have either high or low tone; falling and rising tones are rare. Nearly all stems appear in two or more phonemic shapes. (p.45)

705 $a **MORPHOLOGICAL STRUCTURE OF WORDS** $A "Navaho morphemes divide into...prefixes, stem, and enclitics. A word...may consist of a single free stem or it may be polymorphemic, having as few as two morphemes, or as many as ten." (p.13) Hoijer distinguishes between derivational and paradigmatic (i.e. inflectional) prefixes, "DPr" and "PPr" respectively. In nouns the order is (PPr)(DPr)N. Verbal forms are more complex; Hoijer finds ten separate positions in the verb, not counting enclitics: (1) DPr, (2) PPr (iterative, etc.), (3) PPr, (4) PPr (object pronoun), (5) PPr (subject pronoun-fourth person), (6) DPr, (7) PPr (aspect and mode), (8) PPr (subject pronoun), (9) PPr (classifier), (10) V.

705 $a **MORPHOLOGICAL STRUCTURE OF WORDS** $A Morphophonemic processes occur at many places in the word. Hoijer divides them into those affecting prefixes and those affecting stems. The former include vowel harmony of a limited type, sibilant harmony, tonal assimilation, a variety of more or less productive and regular reductions (loss of vowel or final /h/), and some rather limited and less regular "contractions," which affect primarily the aspect, subject pronoun, and derivational prefixes in verbal forms. Stem alternations are divided into suppletive alternations (very widespread in nouns and verbs), modification of verb stem initial consonants by a preceding consonant, and modification of verb stem by enclitics.

705 $a **MORPHOLOGICAL USE OF PHONOLOGICAL PROCESSES** $A Many morphological categories, particularly in the verb, are distinguished "phonologically." For example, the imperfective and perfective stems of the verb may differ only in that one has a short vowel and the other a long vowel or one has a high tone and the other a low tone. It is not, however, possible to predict whether it is the imperfective or perfective stem which has the long vowel (or high tone) since both cases occur. That is, for one verb it may be the imperfective stem which has the short vowel, while for another verb it is the perfective stem which has the short vowel. Thus, vowel lengthening or tone shift may signal a switch from one morphological category to another, but the direction of the phonological shift is a lexical property of individual verbs. Among the phonological processes which are used to maintain such distinctions are the following: (1) a short vowel is lengthened or a long vowel is shortened. (2) One vowel is changed into another (e.g. /epsilon/ to /a/. (3) A high tone becomes low, or a low tone becomes high. (4) A high tone on a long vowel alternates with a low tone on a short vowel. (5) A short vowel with a low tone alternates with a (different) long vowel with a low tone. (6) A long vowel with a high tone alternates with a diphthong with a low tone. (7) A short vowel with a low tone alternates with a (different) long vowel with a high tone. (8) A stem final consonant alternates with zero. (9) A stem final consonant alternates with a different stem final consonant. For further details, see pages 56-67.

705 $a **NASALIZED VOWELS** $A "All oral vowels which follow consonantal /n/ are nasalized: the distinction between oral and nasal vowels is lost in this position. A similar, though less marked, nasalization affects oral vowels preceding either consonantal or syllabic /n/." (p.11)

705 $a **PHONOLOGICAL WORD** $A The word consists of a sequence of evenly stressed syllables, each bearing a tone. Word initial syllables always begin with a consonant (if syllables with syllabic /n/ are included). Syllabic /s-hacek/ and syllables consisting of a single short or long vowel (V or VV) occur only word finally. A syllable of the type V occurs only after a long vowel, a syllable of the type VV only after a short vowel. Syllabic /s/, /z-hacek/ and /l-fricative/ only occur word medially. The word always ends in a consonant; when a vowel occurs finally, /h/ is added. (See p.3-5.)

705 $a **STRESS** $A "The Navaho utterance...is made up of one or more evenly stressed syllables." (p.3)

705 $a **SYLLABLE** $A CV(V)(C) $A "The syllable usually begins with a consonant.... Any consonant may

begin a syllable." Other syllable types consist of a syllabic /n/ (which may be followed by a consonant), a long or short vowel, or a syllabic fricative. All syllables but the fricatives carry a tone. The syllabic nasal is a reduction of nasal plus vowel. (See p.3-5.) $A VV clusters: all long V and /a, epsilon, o-open/ + /iota/; /a, epsilon, iota/ + /o-open/; /a-nasalized, epsilon-nasalized/ + /iota-nasalized/; /a-nasalized/ + /o-open-nasalized/

705 $a **TONE** $A domain of tone: mora $A "Each syllable in a Navaho utterance, excepting only those which are syllabic sibilants, contains one tone phoneme, if it has a single syllabic [i.e. a short vowel-MR], or two tone phonemes, if the syllabic is doubled" [i.e. a long vowel or diphthong-MR]. Sequences /high.low/ and /low.high/ may occur on long V and diphthongs, and are treated as clusters here. (p.12)

705 01 $A "Both /t-aspirated/ and /k-aspirated/, which occur only as syllable and word initials, usually have a velar aspiration. Before the vowels /a/ and /a-nasalized/ the aspiration is back velar, before the front vowels it is front velar, and before /o-open/ and /o-open-nasalized/ it is labiovelar. There is, however, some variation among Navaho speakers in respect of the velar aspiration; in many instances in his texts, Sapir has recorded [t.h] and [k.h], regardless of the following vowel." (p.6)

705 02 $A [c-fricative, j-fricative] are described as "front velar."

705 03 $A "In both /t-ejective/ and /k-ejective/ glottal and oral closures are released simultaneously in normal speech; in slower speech the glottal closure survives the oral." (p.7)

705 04 $A "/k-aspirated-labialized/...occurs only as a syllable and word initial before /epsilon/ and /iota/. In this position it is aspirated and labialized, but it does not seem to have the velar aspiration of /t-aspirated/ and /k-aspirated/." (p.7)

705 05 $A "It should be noted that the aspiration of /t/s-aspirated/, while usually [h], may upon occasion become velar in the same way (and with the same variants before the vowels) as in the case of /t-aspirated/ and /k-aspirated/." (p.7)

705 06 $A Exact point of articulation for the laterals is not specified. [MR]

705 07 $A "/x/ and /gamma/ vary considerably in place of articulation depending on the vowel which follows. Before /a/ and /a-nasalized/, /x/ and /gamma/ are back velar, before /epsilon, epsilon-nasalized, iota, iota-nasalized/, both are front velar, and before /o-open/, both are velar and labialized (neither occurs before /o-open-nasalized/)." (p.9)

705 08 $A [j-fricative] is "often so lightly spirantized as to be confused with /yod/." (p.9)

705 09 $A Resemblance of [gamma-labialized] to /w/ suggests weak friction. [JHC]

705 10 $A "In /m-preglottalized/ and /n-preglottalized/ the glottal closure precedes the continuant." (p.8)

705 11 $A "In the final position of the word, /n/ takes on a semisyllabic quality." (p.8)

705 12 $A "As a word initial.../h/ has allophones which are very similar to those of the phoneme /x/: back velar before /a/, front velar before /epsilon/ and /iota/, and labialized velar before /o-open/. These allophones are not, however, identical with those of /x/: each is given a somewhat briefer and less fortis articulation than is the case with the allophones of /x/." (p.9)

705 13 $A "/a/ and /a-nasalized/...may vary freely from the low central position to a position somewhat more to the front." (p.11)

705 14 $A "/yod/...has but one allophone, a deliberate and almost spirantal glide which is quite different from the frictionless glide of English 'yes.'" (p.10)

705 15 $A "In articulation [of /yod-preglottalized/], the [glottal stop] is released into the following /yod/." (p.10)

705 30 $A "/k-aspirated-labialized/ is a rare phoneme." (p.7)

705 31 $A "All three velar spirants /x, gamma, x-labialized/ appear only as syllable and word initials. /x/ is frequent in both positions, /gamma/ is rare as a word initial but otherwise frequent, and /x-labialized/ is found only before the vowel /epsilon/ in two forms (and their derivatives) borrowed from Spanish." (p.9)

705 32 $A "/w/ is a rare phoneme; it occurs only as a syllable and word initial before the vowels /a, a-nasalized, epsilon/. It varies in pronunciation from a simple [w] to a [w] which is preceded by a barely audible voiced velar spirant. /w/ is, in fact, quite similar to the [gamma-labialized] allophone of /gamma/, except that, in the latter, the preceding velar spirant is more clearly audible." (p.10)

705 33 $A "/m/ is a relatively rare phoneme and occurs only as a syllable and word initial." (p.8)

705 34 $A /m-preglottalized, n-preglottalized, yod-preglottalized/ are rare, only occur syllable initially, and only as the result of a morphophonemic process. (p.8-10)

705 35 $A "/n/, one of the commoner Navaho phonemes, is found initially and finally in both syllable and word, and also as a syllabic." (p.8)

705 37 $A It appears that in word initial position /h/ really has become /x/, and that Hoijer is distinguishing the two on morphophonemic rather than phonetic grounds. In medial position, syllable initially, /h/ may also be strengthened to /x/. In word final position there is no phonetic difference between basic /h/ and the [h] which is added to final vowels. /h/ also occurs in syllable final position, where syllables of the basic form CVh are distinct from CV syllables. (p.3-4) However /x/ does not occur syllable finally. One is left wondering whether Hoijer's distinction between /h/ and /x/ is real. [JHC]

705 38 $A "There is some confusion in the literature in respect to /h/ and /h-labialized/, and some disagreement. Reichard does not find.../h-labialized/ at all.... Haile also disregards /h-labialized/.... We find that.../h-labialized/, which is found far less commonly than /h/, occurs only word initial and as the initial of syllables which are medial or final in the word; it is never a syllable or word final." (p.9)

705 60 $A Final /t/ and /k/ are "usually unexploded." (p.5)

705 61 $A /t-aspirated, k-aspirated, t/s-aspirated/ are realized as [t/x, k/x, t/s/x] before /a/ and /a-nasalized/.

705 62 $A /t-aspirated, k-aspirated, t/s-aspirated/ are realized as [t/c-fricative, k/c-fricative, t/s/c-fricative] before front vowels.

705 63 $A /t-aspirated, k-aspirated, t/s-aspirated/ are realized as [t/x-labialized, k/x-labialized, t/s/x-labialized] before back rounded vowels.

705 64 $A "As an initial, /k/ is often followed by a voiced spirantal glide [gamma] which is back velar before /a/ and /a-nasalized/, front velar before /epsilon, epsilon-nasalized, iota, iota-nasalized/, and velar and labialized before /o-open/ and /o-open-nasalized/." (p.5)

705 66 $A /s, s-hacek, z-hacek, l-fricative/ become syllabic between /glottal stop/ and a following C or word boundary. [s-hacek-syllabic] is only found finally, the others only medially. (p.5) (Actually Hoijer seems to regard the syllabics as separate phonemes, but it looks as though the non-syllabics are in complementary distribution with the highly restricted syllabics, so the allophonic analysis is used here. [JHC])

705 67 $A [x-labialized] is an emphatic variant of /h-labialized/ occurring in word initial position. (p.10) It is also the normal allophone of /x/ before /o-open/. (p.9)

705 68 $A /gamma/ is realized as [j-fricative] before front vowels. (As presented by Hoijer on p.9 it appears that the fronted allophone of /gamma/ sometimes, but not always, is indistinguishable from /yod/. But it seems from the comment on p.10 that the two are being distinguished on historical rather than phonetic grounds. In other words, /gamma/ and /yod/ have merged before /iota/ and /epsilon/ (assuming they once were distinguished). [JHC])

705 69 $A /gamma/ is labialized before /o-open/.

705 70 $A "[n-syllabic] occurs in the initial, medial, and less often, the final position within the word. It does not occur independently. [n-syllabic] may be followed by any syllable type except V, VV [= long vowel or diphthong], and the consonantal syllabics. [n-syllabic] is nearly always an optional, but preferred alternant of nV.... /n-syllabic.C/ syllables occur initially and medially in the word, but not in final position or independently." (p.4-5)

705 71 $A /epsilon/ is realized as [e] "in the cluster [e.i]." (p.11)

705 72 $A /epsilon-nasalized/ is realized as [e-nasalized] "in the cluster [e-nasalized.i-nasalized]." (p.11)